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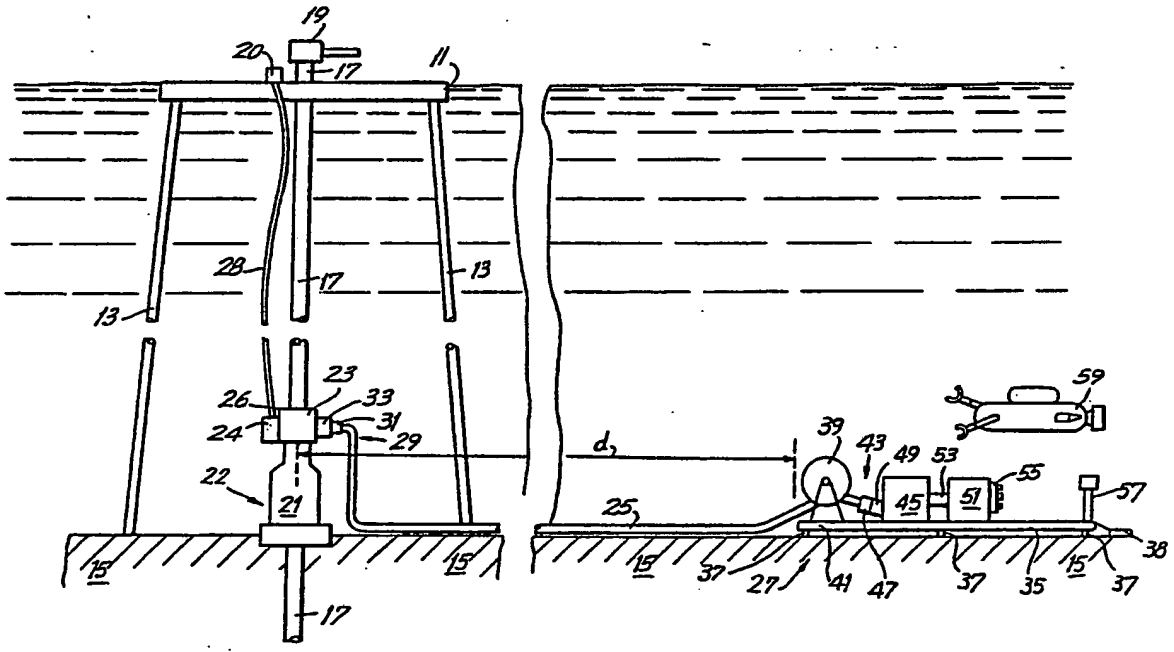

(57) Abstract

A device for activating a blowout preventer (23) on a wellhead (21) in a body of water comprising an underwater station (27) located on the floor of the body of water at a distance away from the wellhead (21) sufficient to avoid injury or damage to person or property at the underwater station (27) when a blowout occurs, a signalling device (57) to locate the underwater station (27) and a conduit (25) extending between the underwater station (27) and blowout preventer (23) for activating the blowout preventer (23).

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TITLE: SYSTEM FOR ACTIVATING A BLOWOUT PREVENTER

BACKGROUND OF THE INVENTION

This invention relates to a device for activating a blowout preventer.

During offshore exploratory drilling operations, the primary function of a blowout preventor ("BOP") is used to close a well in an emergency situation in order to prevent a blowout of high-pressure well fluids. In the past, the blowout preventer was activated either hydraulically or electronically from a drilling platform above the surface of the water. However, in an emergency situation, it may be impossible to activate the blowout preventer from the drilling platform because of the hazardous conditions or destruction of equipment caused by the blowout. When the blowout preventer is activated accoustically by remote control from the drilling platform, it may be impossible to activate the blowout preventer due to interference with the remote signal caused by the noise from the blowout. Additionally, the fact that the blowout preventer is activated from a point above or in close proximity to the wellhead increases the likelihood of personal injury during its operation due to the destruction and confusion which may accompany a blowout situation.

SUMMARY

The present invention includes an underwater station from which the blowout preventer on a wellhead is activated to shut off the flow of fluid from the well. The station is placed on the floor of the body of water at a safe distance away from the wellhead and is operably connected to the BOP so that the BOP may be closed from the underwater station.

One general object of the invention is to overcome the problems associated with activating a blowout

preventer from a point above or in close proximity to the blowout site.

More specifically, it is an object of the present invention to provide a device and method for closing the BOP from an underwater position in order to minimize the risk of injury or damage to person or property when a blowout occurs.

It is also an object of the invention to provide an underwater station from which the blowout preventer may be activated by an underwater vehicle such as a free-swimming submersible remote control vehicle, a diving bell or by a diver in an atmospheric system suit.

Another object of the invention is to provide an installation on the floor of the body of water from which a fluid, i.e., liquid or gas, may be pumped or released to a blowout preventer to close the drill pipe.

An additional object of the invention is to provide a remote underwater station from which the BOP may be activated by sending an electronic signal to the BOP through the hard wire connection.

A still further object of the invention is to provide a remote underwater station for activating the blowout preventer which is locatable by a signal which emanates from the station.

In one illustrative embodiment of the invention, the system includes an underwater station which is located at the bottom of the body of water. The distance between the station and the blowout preventer, which is mounted at the drill site, is sufficient to avoid any injury or damage to person or property at the underwater station when a blowout occurs at the drill site. A signal device is provided for locating the station by, for example, a submersible vehicle. Once the station is located, the submersible vehicle travels to the station and activates the blowout preventer from the station, by passing a fluid through the inlet of a conduit which extends from the underwater station to the blowout preventer.

In another embodiment, a hard wire connection is provided between the BOP and the remote underwater station. An electronic signal may be sent to activate the BOP through the connection from the remote station.

In accordance with other features of the invention, the station is located at a safe distance, for example, at least 300 feet from the drill site and is provided with a signalling device which is detectable by sonar. The conduit is a high-pressure hose, and the blowout preventer is activated by a hydraulic fluid which is brought to the underwater station or stored in a container at the underwater station.

In accordance with another feature of the invention, the signalling device may be an electronic transducer, an accoustic transducer, receiver or a visually detectable device.

In accordance with a further feature of the invention, the conduit is a high-pressure hose containing an electrical conductor, and the BOP is activated by applying an electrical signal through the conductor from the underwater station to the BOP.

In accordance with another feature of the invention, the station includes a platform which is lowered to the bottom of a body of water at the drill site, and the outlet end of the conduit is attached to the blowout preventer. The bottom of the platform is provided with runners or wheels to assist the movement of the platform to its final location at a safe distance, for example, at least 200 feet and not more than 400 feet, from the wellhead. As the platform is slid or rolled away from the wellhead to its final location, the conduit is dispensed from a reel on the platform which was also used to store the conduit.

In accordance with further features of some embodiments of the invention, the underwater station includes a hydraulic fluid container and pump which are used to store and pump hydraulic fluid, i.e., gas or

liquid, from the station to the blowout preventer to actuate the blowout preventer. The underwater station may also be provided with its own power supply for the pump.

In accordance with additional features of some embodiments, a pressure accumulator is connected to the hose inlet through a shut-off valve, and the blowout preventer is activated by opening the shut-off valve, thereby forcing the hydraulic fluid through the hose to the blowout preventer.

In other embodiments of the invention, the underwater station is provided with a connector and valve assembly which may receive pressurized fluid from an outside supply.

In an additional feature of the invention, the underwater station may include one or more electrical connections which permit the station to receive electrical signals and send the signals to the BOP. The electrical signals may originate from, for example, an underwater vehicle or diver operating at or at a position remote from the underwater station.

In accordance with a further feature of one or more embodiments, the underwater station is provided with a controlled transmitting device to send an electrical signal through and electrical conductor to activate the BOP. The transmitting device may be mechanically, electronically or acoustically operated from the underwater station or from a position remote from the underwater station.

These and other objects, features and advantages of the invention will be more readily understood from the following description of certain preferred embodiments, when read with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an illustration of an offshore well installation employing an underwater station embodying the invention;

Figure 2 is an illustration of an underwater station of the present invention which is being operated by a submersible vehicle;

Figure 3 is a cross-sectional view of a portion of the station showing a pressure accumulator and valve system which may be used to supply fluid to the blowout preventer;

Figure 4 is a cross-sectional side view of a pressure compensator utilized with the high-pressure hose; and

Figure 5 shows a section of the underwater station and wellhead illustrating a control device for sending an electrical signal through a cable to activate the BOP.

DESCRIPTION OF CERTAIN PREFERRED EMBODIMENTS

Referring to Figure 1, there is shown an offshore well which comprises a surface platform 11 anchored by cables 13 extending between the bottom of the platform and the floor 15 of a body of water. A drill pipe or riser 17 extends through surface platform 11 into the floor 15 of the body of water. Suitable control equipment 19 is provided on the drill pipe 17 on the surface platform 11. A wellhead 21 is secured at the marine floor 15 around drill pipe 17 at the drill site 22. A blowout preventer 23 is mounted above wellhead 21 to drill pipe 17.

Typically, the blowout preventer 23 includes a supply container 24 of hydraulic fluid which is used to close the BOP. The BOP's supply of hydraulic fluid is generally activated by a control 20 on platform 11 through electrical cable 28 and solenoid 26 which connect control 20 and supply container 24.

In the present invention, the blowout preventer is also activated by a system including a high-pressure hydraulic hose 25 which lies on the floor of the body of water and extends between the blowout preventer and underwater station 27. The outlet end 29 of hose 25 is connected to the blowout preventer through a one-way valve 31 and fitting 33.

Underwater station 27 includes a submerged station platform 35 which is mounted to floor 15 on legs 17 at a distance "d" from the wellhead 21. Anchor 38 is attached to station platform 35 to floor 15.

A rotatable reel 39 is attached to the front end 41 of station platform 35. High-pressure hose 25 is wound around reel 39 which stores and dispenses the hose. Inlet end 43 of hose 25 extends from reel 39 and is attached to pump 45 through pump valve 47 and pump fitting 49. Pump 45 is mounted on station platform 35 to the rear of reel 39. Container 51 housing the hydraulic fluid is secured to station platform 35 to the rear of pump 45 and is connected to pump 45 through feedpipe 53. Container 51 is provided with control panel 55 which is used to operate the pump 45 and control the flow of hydraulic fluid from container 51 through pump 45 into inlet 43. A signalling device 57 is mounted at the rear end 63 of station platform 35 for detection of underwater station 27 by submersible vehicle 59.

Figure 2 illustrates another embodiment of underwater station 27. In this embodiment, a submersible vehicle platform 61 is attached to the rear end 63 of station platform 35 by two legs 65. A series of runners 67, one of which is shown for the sake of clarity, is secured to the lower end of legs 37 of station platform 35. Runners 67 sit on the floor 15 of the body of water and assist the slidable transport of the underwater station 27 along the floor 15 to its desired location. Towing ring 69, securely fastened to rear end 63 of station platform 35,

assists in towing the underwater station to its desired location.

A submersible vehicle, such as submarine 71 on submersible vehicle platform 61, may be used to tow platform 35 to its final location and controls the pumping of hydraulic fluid through high-pressure hose 25 to blowout preventer 23.

Electrical connecting cable 73 extends between submarine 71 and the pump control panel 55 through appropriate pump control panel fitting 75 and submarine fitting 77. Connecting cable 73 connects submarine control panel and pump 45 and permits operation of pump 45 from submarine control panel 79, so that fluid in container 51 may be pumped by pump 45 through high-pressure hydraulic hose 25 to the blowout preventer 23.

Manual controls 91 on pump control panel 55 may also be used to operate pump 45 to supply hydraulic fluid to the blowout preventer. A maneuverable arm 93 on submarine 79 may be actuated through appropriate controls from submarine control panel 79 to operate manual controls 91.

A connecting hose 81 is also provided between the control panel 55 and submarine 71. Connecting hose 77 is attached to pump control panel 55 through pump control panel fitting 83 and to the submarine through submarine fitting 85. A submarine pump 87 is in fluid connection with a submarine container 89 containing a hydraulic fluid and both are inside of submarine 71. Fitting 83 is in fluid connection through a series of bypasses (not shown) in container 51 and pump 45 with high-pressure hose inlet 43. The submarine pump 87 is electrically connected to and may be controlled by control panel 79 to deliver a high-pressure hydraulic fluid from container 89 through connecting hose 81 to inlet 43 of hydraulic hose 25. Alternatively, since the submersible vehicle is provided with the hydraulic fluid, pump and control mechanisms, connecting hose 77 of the submersible vehicle may be

directly connected to valve 47 and fitting 49 in order to pump hydraulic fluid to the blowout preventer.

Referring next to Figure 3, there is illustrated another embodiment of the invention in which pressure accumulator 95 is mounted on station platform 35, instead of the pump and container system illustrated in Figs. 1 and 2. The pressure accumulator is located to the rear of reel 39 on the front end 41 of station platform 35. The pressure accumulator 95 is connected to high-pressure hydraulic hose 25 through accumulator fitting 97 and three-way valve 99. Three-way valve 99 is operable to permit fluid flow from the pressure accumulator 95 to high-pressure hydraulic hose 25 when in the open position. When valve 99 is closed, the flow of hydraulic fluid is prevented, thereby maintaining the pressurized hydraulic fluid inside pressure accumulator 95. A third opening which is open to the body of water is provided in three-way valve 99 so that when valve 99 is closed, fluid leakage from the accumulator 95 will not inadvertently pass through hose 25 to activate the blowout preventer but will pass harmlessly through the third opening into the body of water.

Accumulator control panel 101 is attached to pressure accumulator 95 and is used to control the operation of pressure accumulator 95. A series of controls 103 are provided on control panel 101 to operate the pressure accumulator, either manually, accoustically or electronically.

Referring next to Figure 4, there is illustrated a pressure compensation system 105 which may be provided in high-pressure hydraulic hose 25. A cylinder 107 forms the outer chamber of a pressure accumulator. Inside the cylinder 107 in upper region 109 is the high-pressure hydraulic fluid. A piston 111 extends between the inner walls of cylinder 107 and maintains the fluid inside region 109 in a pressurized condition. The edges 112 of piston 111 are appropriately sealed to prevent leakage of

hydraulic fluid out of upper region 109. The piston 111 is spring-loaded by spring 113 which is supported between the bottom of piston 111 and the inner wall at the bottom 114 of cylinder 107. Openings 115 in cylinder 107 permit the passage of water into a lower region 117 of cylinder 107 to maintain equal pressure in upper region 109 and lower region 117. Piston 111 is movable so as to adjust the pressure of fluid in upper region 109 and maintain equilibrium between the pressure in upper region 109 and lower region 117 of cylinder 107. The upper region 109 of cylinder 107 is in fluid connection with high-pressure hydraulic hose 25 through two-way valve 119 which permits the flow of hydraulic fluid back and forth between region 109 and the inside of hose 25, thereby maintaining equal pressure in both.

Figure 5 illustrates another embodiment of the invention for activating the blowout preventer. The system involves the use of hard wire connection between the underwater station and the blowout preventer. An electrical cable 121 extends between blowout preventer 23 and underwater station 27. The electrical cable is wrapped around reel 39, which may be used to dispense the cable. The end of cable 121 at the underwater station 127 is connected to a control box 123. The other end of cable 121 is connected to a solenoid 125, which is connected to the hydraulic fluid supply 24 for the blowout preventer 23. The control box 123 is mounted on platform 35 and is used to send an electrical signal through cable 121 to activate the blowout preventer 23, using the blowout preventer hydraulic fluid supply 24 to close the blowout preventer. The control box 123 may also receive a signal such as an accoustical signal or electronic signal from a remote source which triggers the control box 123 to send the electrical signal through cable 121 to actuate the blowout preventer. The remote control signal may be provided by, for example, a submersible vehicle or a diver.

Alternatively, the control box 123 may be operated from the underwater station through an electrical connection with a submersible vehicle or manually by a diver.

This hardwire electrical system for activating the blowout preventer may be used either alone or in conjunction with a fluid activated system such as the system shown in Figure 1.

In use, the underwater station 27 of the present invention may be lowered into the body of water from surface platform 11 to the floor 15 at the drill site 22. The underwater station 27 may be lowered by any conventional means such as a crane mounted on surface platform 11 or by attaching it to a submersible vehicle which brings it to the floor 15 of the body of water. Once at the bottom, the outlet end of high-pressure hydraulic hose 25 is attached through valve 31 and fitting 33 to blowout preventer 23. Valve 31 may be a one-way valve which prevents a back flow of hydraulic fluid from the blowout preventer 23 to hydraulic hose 25.

In the embodiment shown in Figure 1, underwater station 27 includes station platform 35 on which is mounted reel 39, pump 45, fluid container 51, and signalling device 57. Hydraulic hose 25 is stored on reel 39.

The station 27 is transported to its final destination on the floor 15 of the body of water by sliding it along the floor 15 of the body of water on runners 67, as shown in Figure 2. In place of the runners 67, the underwater station 27 may be provided with another suitable device, such as wheels, in order to assist the movement of the underwater station to its final location. As the station is moved to its final location, reel 39 dispenses hydraulic hose 25 until the platform reaches its final destination, whereupon it is anchored to anchor 38 to the floor 15 of the body of water. The final destination for the underwater station 27 on the floor of

the body of water is a distance "d" from wellhead 21. The distance "d" is a safe distance from the wellhead in case of a blowout. This distance should be at least a distance which will be sufficient to avoid injury to persons or damage to property when a blowout occurs. Generally, the distance "d" should be at least 100 feet from the wellhead. Preferably, "d" is at least 200, and not more than 400 feet, but may also be at least 300 feet.

In placing the underwater station, the current, the depth of the water, and the topography of the floor 15 of the body of water should be considered. It is preferable that the station 27 be positioned so that the direction of the current is perpendicular to a line between the drill site 22. This is to avoid any problem such as a diver being drawn toward a blowout site if station 27 is placed upcurrent of the drill site 22 or such as debris from a blowout travelling toward the underwater station 27 if the station is placed downcurrent of the drill site 22. As to the depth of the water, the station placement should be further away from the drill site 22 as the water depth increases. As to the topography, it is desirable to place the station on a section of the floor 15 which is firm and level.

Additionally, in placing the station 27, instead of lowering the station at the drill site 22, the station may be lowered at its final destination in which case hose 25 is dispensed from reel 39.

To activate the BOP from the underwater station 27, a submersible vehicle 59 (shown in Figure 1) may proceed to the platform and operate control panel 55 to actuate pump 45 to pump hydraulic fluid from container 51 through feedpipe 53, pump 45, fitting 47 and valve 47 into inlet end 43 of hose 25 to the BOP 23.

If the control panel 55 is operated by a submersible vehicle, such as submarine 71 shown in Figure 2, an electrical connecting cable 73 may be connected between submarine 71 and control panel 55 and the submarine

control panel 79 may be utilized to operate the system. The submarine 71 may also have its own submarine pump 87 than container 89 for hydraulic fluid, in which case, the submarine is used to pump hydraulic fluid through connecting hose 81 and feed hydraulic hose 25 either through the bypasses (not shown) in container 51 and pump 45 or by attaching hose 81 directly to valve 47 and fitting 49. Instead of using a submersible vehicle 59, the control panel may be activated by the diver or even by a remote signal, such as an acoustical or electromagnetic signal emanating from the submersible vehicle and received by control panel 55. If the control panel 55 is operated by a remote signal, the underwater station 27 and the source of the remote signal should be outside of a range where interference caused by a blowout would interfere with the signal. For example, a submarine 71 would travel to a region proximate to the underwater station, such as, a distance within about 200 feet of the underwater station, and provide an accoustic or other suitable signal to activate the controls 103. As long as the submarine 71 sends the signal from a distance away from the wellhead which is sufficient to avoid interference caused by the blowout, that is, at least 100 feet from the wellhead, there would be no danger of having the signal disrupted by the blowout.

In order to locate the underwater station a signalling device 57 is used which may be, for example, a sonar signal, a transponder, a radar reflector, beacon light or other suitable means for locating this station. The signalling device may also be a flotation apparatus which is visible from the surface of the water.

The blowout preventer 23 may also be fed with hydraulic fluid from a pressure accumulator 95 which is mounted on the station platform 35, as shown in Figure 3. By operating a series of controls 103 which are provided on control panel 101 of the accumulator 95, three-way valve 99 is moved from a closed to an open position in

order to permit the pressurized hydraulic fluid to pass from accumulator 95 to hose 25. This fluid passes through accumulator fitting 97 and valve 99 into hydraulic hose 25 to activate blowout preventer 23.

The controls 103 of accumulator 95 may be operated by any suitable means, for example, manually or electrically by a diver or submersible vehicle or even by the receipt of a remote signal.

Instead of utilizing a fluid connection between the underwater station 27 and the blowout preventer 23 (as shown in Figures 1, 2 and3), a hardwire connection such as the one shown in Figure 5 may also be utilized. In this system, a control box 123 at the underwater station 27 is connected to the hydraulic fluid source 24 of blowout preventer 23 through a conducting electrical cable 121 and solenoid 125. By operating control box 123, a signal may be sent through cable 121 to hydraulic fluid source 24 which will supply the blowout preventer with hydraulic fluid in order to activate it. The hardwire connecting system may be utilized either alone or together with one of the fluid connecting systems shown in Figures 1, 2 or 3.

When the hydraulic hose 25 of the systems shown in Figures 1, 2 or 3 is lowered into the body of water, the hose 25 may be primed with hydraulic fluid. As the depth of the water increases, the pressure on the hose 25 will increase. In order to prevent accidental actuation of the blowout preventer 23 or bursting of the hydraulic hose 25, a pressure compensation system 105 may be provided in the hydraulic hose 25. As the hose 25 is lowered into the body of water, the pressure inside and outside of the hose is maintained constant by allowing hydraulic fluid to pass through to a valve 119 into and out of the upper region 109 of the pressure compensation system 105.

As the pressure outside of the hose 25 changes hydraulic fluid passes through valve 119 into or out of upper region 109 of cylinder 107 of the compensation

system. The movement of hydraulic fluid through valve 119 is triggered by spring loaded piston 111. Since the bottom of cylinder 107 is provided with opening 115, water from the surrounding body of water is permitted to pass into lower region 117 of cyliner 107. The water will push against piston 111 to increase the pressure of hydraulic fluid in hose 25 if the outside water pressure is higher than the hydraulic fluid pressure in hose 25 until the pressures are equal. Likewise, if the pressure inside hose 25 becomes greater than the outside water pressure, piston 111 will be urged against spring 113 to equalize the pressures.

When it becomes necessary to activate the blowout preventer 23, the hydraulic fluid pressure inside hose 25 will increase. Cylinder 107 is constructed such that cylinder bottom 114 limits the amount of movement of piston 111 and thereby permits fluid in hose 25 to be pressurized to the required level to activate the blowout preventer.

The hydraulic fluid may be a liquid or gas. Typically, the hydraulic fluid is a liquid glycol/water mixture but may even be filtered seawater. If filtered seawater is utilized it is not necessary to store the hydraulic fluid in the submersible vehicle or at the underwater position.

The terms and expressions employed herein are terms of description and not limitation. There is no intention to exclude any equivalence of the features shown and described. It is recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. A device for activating a blowout preventer on a wellhead in a body of water comprising:

an underwater station located on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person or property at the underwater station when a blowout occurs;

signal-producing means for determining the location of said underwater station; and

means extending between said station and the blowout preventer for activating the blowout preventer.

2. A device for activating a blowout preventer on a wellhead in a body of water comprising:

an underwater station located on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person or property at the underwater station when a blowout occurs;

signal-producing means for determining the location of said underwater station; and

conduit means extending in fluid connection between said station and the blowout preventer for passing a fluid to the blowout preventer to actuate the blowout preventer, said conduit means being provided with an inlet for receiving a fluid at the underwater station.

3. A device for actuating a blowout preventer on a wellhead in a body of water comprising:

an underwater station located on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person or property at the underwater station when a blowout occurs;

a signalling device at the underwater station;

a high pressure hose provided with an inlet and an outlet, extending in fluid connection between the station and the blowout preventer and operatively connected at the outlet to the blowout preventer to allow the actuation of the blowout preventer by the passage of a high pressure hydraulic fluid into the inlet, through the hose, out of the outlet and into the blowout preventer; and

container means at the underwater station for storing the hydraulic fluid.

4. A device for actuating a blowout preventer in a wellhead in a body of water comprising:

an underwater station located on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person or property at the underwater station when a blowout occurs;

means at the underwater station for signalling a submersible vehicle;

a high pressure hose provided with an inlet and an outlet, extending between the station and the blowout preventer and operatively connected at the outlet to the blowout preventer to allow actuation of the blowout preventer by the passage of a high pressure hydraulic fluid into the inlet, through the hose out of the outlet and into the blowout preventer;

means for storing and selectively dispensing a length of the high pressure hose from the underwater station; and

means on said underwater station for assisting slidable movement of the underwater station along the floor of the body of water.

5. The device of claim 1, 2, 3 or 4 wherein the distance is at least 100 feet away from the wellhead.

6. The device of claim 1, 2, 3 or 4 wherein the distance is at least 200 feet and not more than 400 feet from the wellhead.

7. The device of claim 1, 2, 3 or 4 wherein the distance is at least 300 feet from the wellhead.

8. The device of claim 2 or 4 further including a source of fluid at said station.

9. The device of claim 2, 3 or 4 further including a source of fluid at the station comprising container means for storing a fluid, connected to means for pumping said fluid through said hose means to activate the blowout preventer.

10. The device of claim 2, 3 or 4 including a fluid source at the station comprising pressure accumulator means for containing a pressurized fluid at a pressure sufficient to activate the blowout preventer, said accumulator connected to the inlet, and valve means, between said accumulator and said inlet, for regulating the flow of pressurized fluid through said hose means, said valve means being selectively operable between open and closed positions, such that in the closed position no pressurized fluid flows from the accumulator to the hose means, and in the opened position, pressurized fluid flows from said accumulator to the blowout preventer to activate the blowout preventer.

11. The device as claimed in claim 10 further comprising a second valve means provided between said pressure accumulator means and the blowout preventer to prevent a flow of fluid out of the blowout preventer in the direction of the pressure accumulator means.

12. The device as claimed in claim 2, 3 or 4 further including pump means, at said underwater station and in fluid connection with the inlet for pumping said fluid to the blowout preventer.

13. The device as claimed in claim 12 further comprising supply means for supplying the fluid at the underwater station for the pump means.

14. The device as claimed in claim 1 or 2 wherein said underwater station is provided with means for dispensing the conduit means between the underwater station and the blowout preventer.

15. The device as claimed in claim 1 or 2 wherein said underwater station includes means for assisting slidable movement of said station along the floor of the body of water.

16. The device as claimed in claim 1 wherein the underwater station is located on the floor of the body of water at a depth of at least 100 feet.

17. The device as claimed in claim 1 wherein the activating means includes electrical conductor means for conducting an electrical signal from the underwater station to the blowout preventer to actuate the blowout preventer.

18. The device as claimed in claim 17 wherein the activating means further includes:

means for selectively producing a first electrical signal at the underwater station for transmission through the electrical conductor means; and

means for receiving, from a source remote from the underwater station, a control signal which controls the selective production of the first electrical signal.

19. A method for actuating a blowout preventer on a wellhead in a body of water comprising the steps of:

locating an underwater station from a distance away from the wellhead which is sufficient to avoid injury or damage to person or property when a blowout occurs; and

activating at said underwater station means extending between the underwater station and the blowout preventer for activating the blowout preventer.

20. A method for actuating a blowout preventer on a wellhead in a body of water comprising the steps of:

detecting a signal from an underwater station on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person of property at the underwater station when a blowout occurs;

using the signal to guide a submersible vehicle to the underwater station; and

supplying a pressurized fluid from the submersible vehicle to the blowout preventer from the underwater station through a conduit which extends between the underwater station and the blowout preventer.

21. A method for actuating a blowout preventer on a wellhead in a body of water comprising the steps of:

submerging an underwater station on the floor of the body of water;

connecting one end of a conduit to the blowout preventer such that said blowout preventer may be actuated by passing a pressurized fluid through said conduit into said blowout preventer, the other end of the conduit being located on said underwater station;

transporting said underwater station under said body of water to a location on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person or property at the underwater station when a blowout occurs;

simultaneously with said transporting, dispensing lengths of said conduit such that the conduit extends between the station and the blowout preventer; and

detecting a signal from an underwater station on the floor of the body of water at a distance away from the wellhead which is sufficient to avoid injury or damage to person or property at the underwater

station when a blowout occurs.

22. The method as claimed in claim 19 comprising the steps of:

locating the underwater station by detecting a locating signal from the underwater station; and

producing an electrical signal at the underwater station for transmission through an electrical conductor extending between the underwater station and the blowout preventer to activate the blowout preventer.

23. The method as claimed in claim 22 wherein said producing step comprises:

producing a control signal from a source remote from the underwater station and a distance away from the blowout preventer which is sufficient to avoid injury or damage to person or property if a blowout occurs; and

receiving the control signal at the underwater station and using the control signal to trigger the production of the electrical signal.

FIG. 1

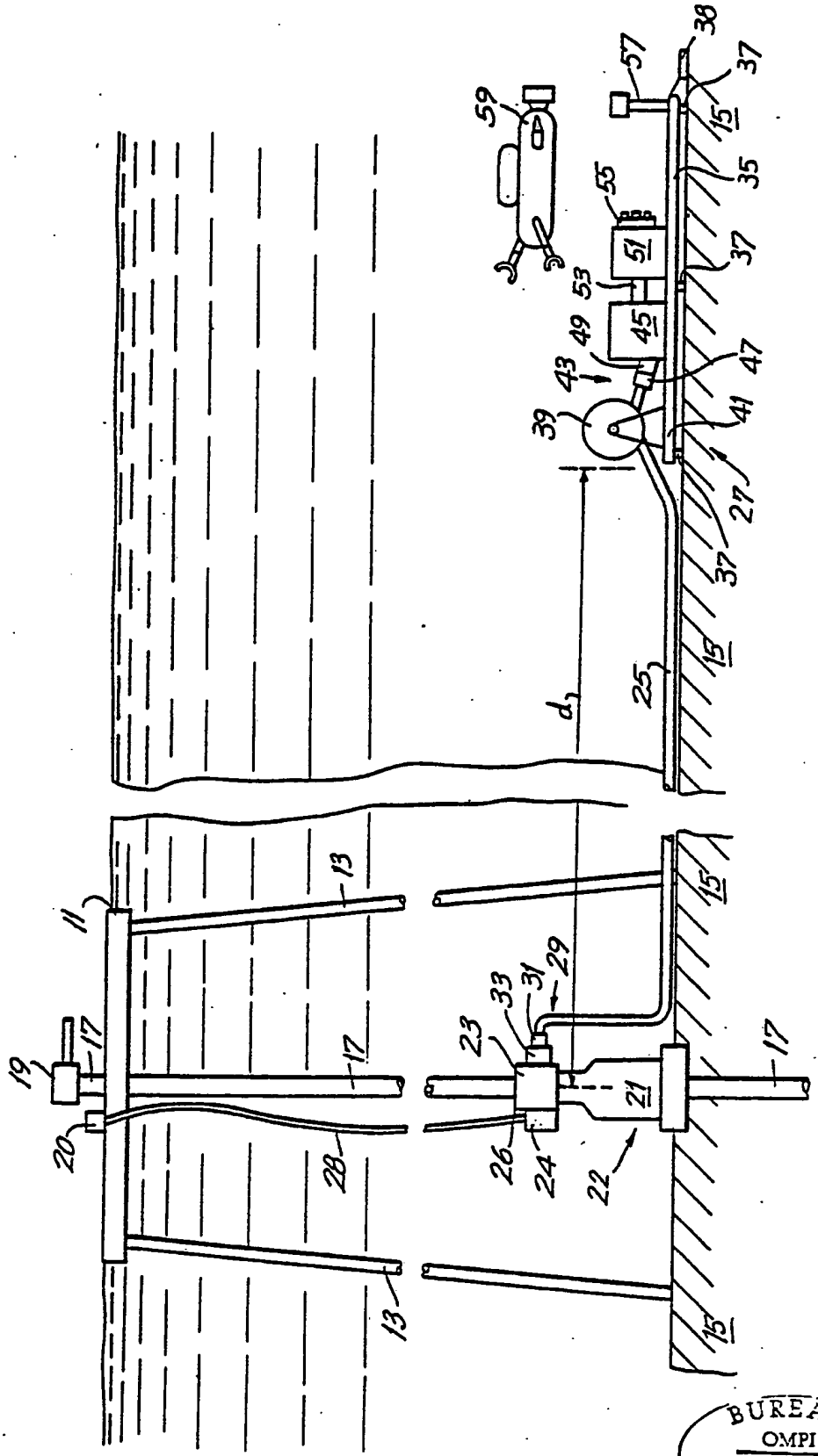
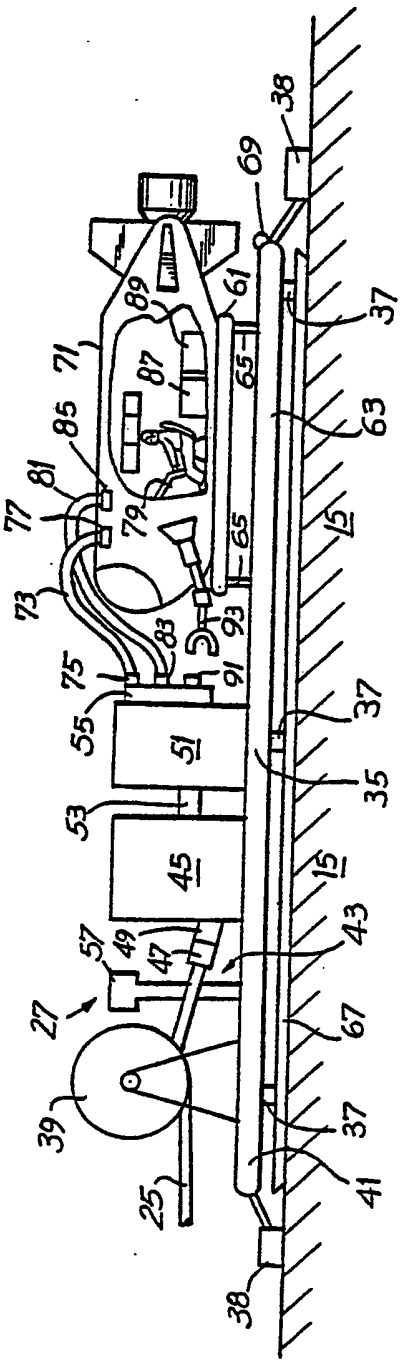


FIG. 2



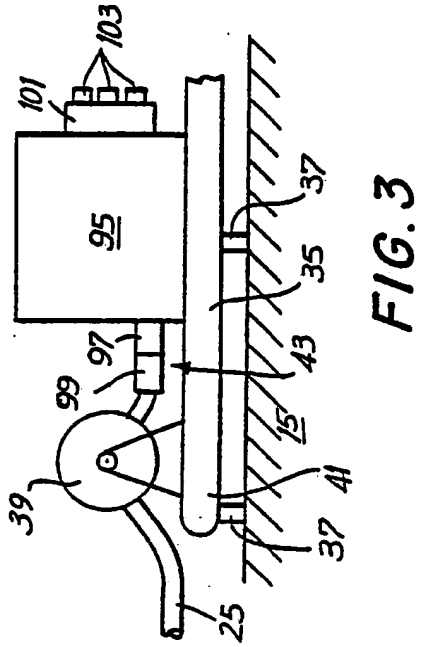


FIG. 3

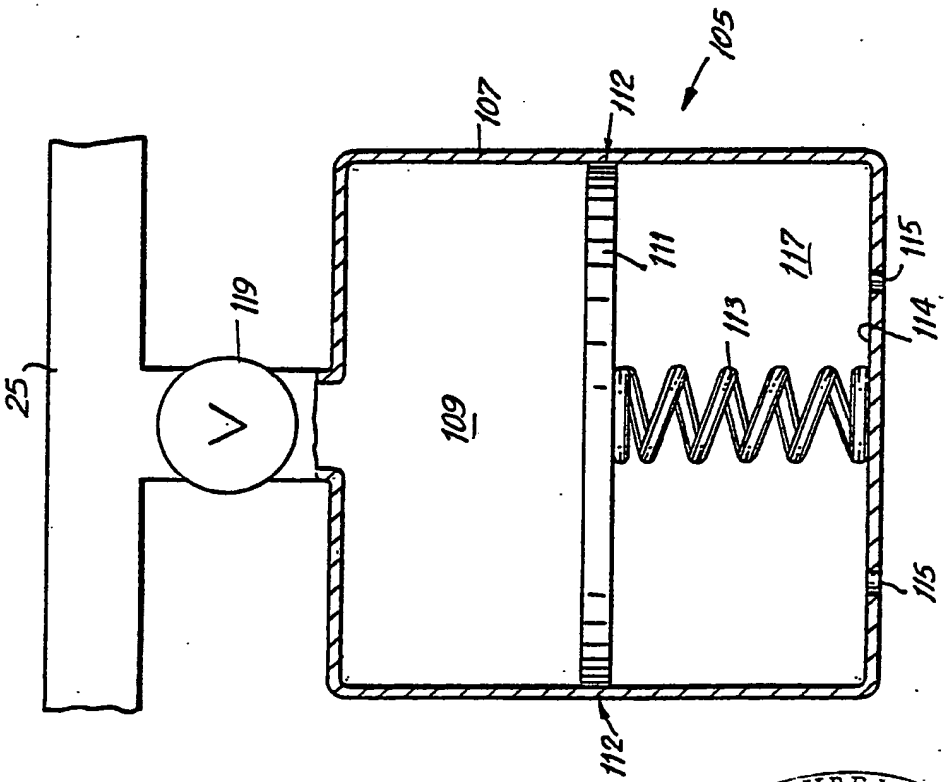
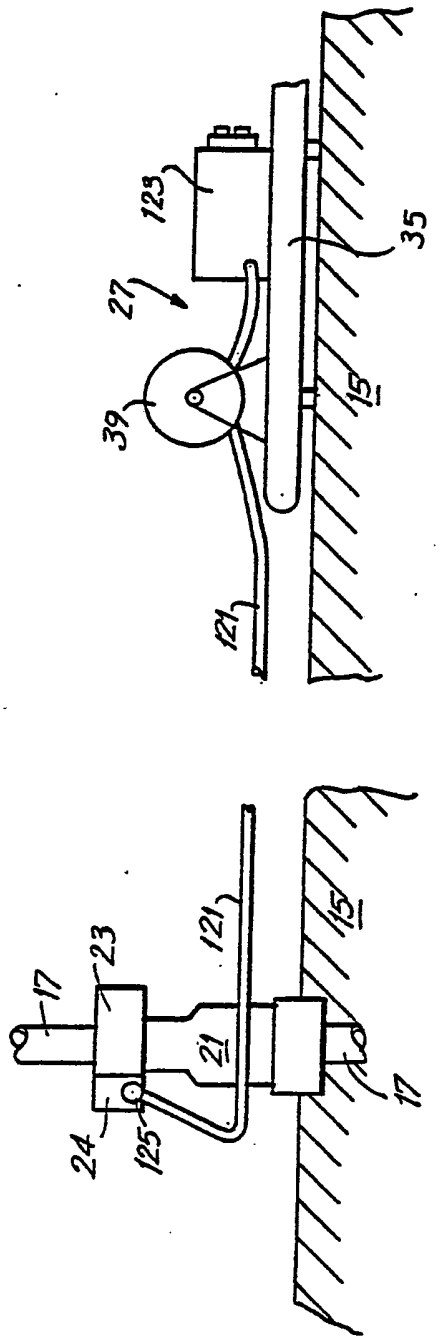


FIG. 4

FIG.5



INTERNATIONAL SEARCH REPORT

International Application No PCT/US83/00131

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL. [3] E21B 33/06
U.S. CL. 166/362

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	166/66, 69, 72, 113, 339, 343, 344, 356, 362, 363, 364, 366, 368, 373, 374, 375 137/236 169/69 405/169, 170

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US, A, 4,036,247 published 19 July 1977 Baugh	10,11
Y	US, A, 3,311,142 published 28 March 1967 Bergstrom	1-23
A	US, A, 3,400,730 published 10 September 1968 Anderson	1-23
Y	US, A, 4,163,477 published 07 August 1979 Johnson et al	1-23
Y	US, E, RE 27,745 published 28 August 1973 Brooks et al	4-13,15,21
Y,P	US, A, 4,329,085 published 11 May 1982 Morrill et al	1-23
Y	US, A, 3,211,223 published 12 October 1965 Hoch	17,18,22,23
A	US, A, 3,504,741 published 07 April 1970 Baker et al	4-13,15,21

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
09 May 1983	27 MAY 1983
International Searching Authority [1]	Signature of Authorized Officer [20]
ISA/US	William P. Neuder W. P. Neuder

Form PCT/ISA/210 (second sheet) (October 1981)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	US, A, 4,046,192 published 06 September 1977 Darnborough et al	1-23
Y	US, A, 4,095,421 published 20 June 1978 Silcox	1-23
A,P	US, A, 4,336,843 published 29 June 1982 Petty	1-23
Y	US, A, 3,055,429 published 25 September 1962 Tausch et al	1-23

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers_____, because they relate to subject matter [12] not required to be searched by this Authority, namely:

2. ☐ Claim numbers_____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

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